Unsolved problems in Mobile Computer Graphics and Interaction

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1 Introduction

With the number of mobile devices exceeding PCs, research is required in many areas with respect to graphics and interaction. There are problems with interaction, streaming, graphics algorithms, bandwidth with current and future devices. This panel examines the state of the art from both an industrial and research point of view, and provides directions for future work in this area.

1.1 Questions and Issues

The panel takes experts from industry and research and examines the issues that face the SIGGRAPH community worldwide in the area of Mobile devices. The problems requiring further research and exposure and are for debate include, desktop vs mobile; adaption of multimedia; power, battery vs electric grid; network connectivity, types of band and size of bandwidth; display, millions of pixels vs thousands of pixels; performance, high power chips vs slower chips; context of use, user is mobile; standards and formats; rendering at terminal vs rendering at server; augmented reality; location independence vs location dependence; interaction techniques; cross cultural interaction; cross network connectivity, WAN v LAN v PAN; computer graphics software design for mobile devices, application development.

The panel has representatives from industry that can provide real world case examples of what problems they have experienced, from manufacture, to human factors.

2 Mark Ollila

Mobile devices are becoming more and more popular world wide, as people carry PDA's, wireless phones, or portable game devices. These devices are becoming more and more ubitiquous and the implementation of applications and various ways to interact are becoming more complex. From the perspective of unsolved problems, these include: dynamic multimedia adaption algorithms; hybrid representations of multimedia data which takes into consideration terminal device and bandwidth; adaptive software components that create applications that reside on the server; context aware agents, that resides on both the client and on the network.

There are many problems that need to be addressed in terms of rendering on a battery limited device with low screen resolution. How do we deal with these problems? How do we use the screen space more effectively? How do we handle interaction with a device when the context that the user will be in is not an office like environment.

2.1 Moderator Ollila bio

Mark has conducted research in many areas of Computer Science - specifically Mobile Technologies, Computer Graphics and Interaction with a touch of Artificial Intelligence. He has worked in administration, programming, new media. He loves innovation and thrives on taking research to industry. An active person, Mark has setup research labs, studios and startups around the world. After leaving Australia to discover his Scandinavian heritage seven years ago, Mark was given the position of Head of Creative Programming at the University of Gävle. Mark worked at the Interactive Institute in Stockholm where he helped developed the strategy proposals for the newly started Mobility Studio. Currently, Mark has a position at Linköping University in building up a Media Technology Institute. He also has a position at the MediaTeam at the University of Oulu, focussing on MobileServices. His current research interests are P2P mobile networks, client side personalization and privacy, emotional artificial intelligence, image based rendering solutions, and theory of gaming. He is a representative for Sweden in the World Internet Project, specifically on Mobile related issues. Mark has a PhD in Computer Vision. He has been on the international committee for SIGGRAPH for 1998,1999,2000,2002.

3 Staffan Björk

The high availability of cheap portable computers combined with wireless communication (via WLAN or mobile phone networks) has increased the interest in various forms of mobile and networked applications. However, most applications try to enable the same functionality that exists on stationary computers without taking into consideration the changed use context. How should one design an interface that is to be used in an environment such as a subway tram where the surrounding light varies? Where the user is constantly being shook? Where the application cannot require the user's attention as he or she is talking with other people? How to design applications that are part of people's lives rather than their work?

Designing applications in this new setting requires a different view on what computer interaction is. Functionality will have to coexist with aesthetic appeal and applications will be defined by how they support the user's activities in the real world rather than what file formats they support in the computer.

3.1 Panelist Björk Bio

Staffan Björk is head of the PLAY research group at the Interactive Institute and has conducted research on Information Visualization

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since 1998 together with Ericsson Usability Lab, Telia Research and Nokia Research Centre. He received a PhD in the autumn of 2000 for his work on the WEST, PowerView, and PowerCom interfaces for small displays. He has concurrently done research within the field of Ubiquitous Computing, most noteworthy Pirates! which was exhibited as part of the Emergent Technologies section of SIGGRAPH 2001.

4   Kevin Bradshaw

Mobile/wireless companies today have a desire to create and deliver real-world, usable and effective interactive digital media applications to wireless devices - devices limited in screen size, user interface, bandwidth, storage capability and power. Despite these limitations, these devices are the most interesting of all areas for research into interactive media design and delivery and they will number well over one billion active users within 4-5 years.

Major problems have been encountered to date even throughout the short lifetime of availability of advanced wireless media terminals. The wireless industry did a good job of standardising and bringing to market interactive text (SMS) terminals, but made a very poor initial job of launching interactive browser terminals. The launch of such devices and services was plagued by incompatibilities amongst vendors, greatly varying implementations of UI standards and thus almost insurmountable barriers to entry for new media developers. This has lead to a very troubled birth for interactive wireless media services.

4.1   Panelist Bradshaw Bio

Kevin Bradshaw founded Digital Bridges in 1998, with the aim of developing a global distribution technology and a set of high-quality entertainment channels for Wireless Internet Users. Prior to Digital Bridges, Kevin spent four years working as a consultant for Consult Hyperion, one of the world's leading electronic and mobile commerce innovators, and the Smith Group, an international Science and Technology consulting organization. Kevin is currently the Chair of the Advisory Board for Digital Bridges and also a Director of the Mobile Entertainment Forum, the first global trade association for Wireless Entertainment. Kevin is the Founder and CEO of MTGP, a strategic advisory and investment group for ventures in Interactive Media Technology. Kevin received his PhD. from Oxford, UK.

5   Steven Feiner

With the latest laptops now packing more 3D graphics power than high-end graphics workstations of a decade ago, it's clear that far more powerful and far smaller mobile devices will follow. One form will be hand-held: phones, PDAs, and gaming platforms. However, another will be head-worn: see-through eyewear, ultimately head-tracked, overlaying graphics on the real world to create augmented reality. Many technical problems remain to be solved before accurately registered, wide field-of-view, sufficiently bright, comfortable and attractive, augmented reality displays will be commonplace. Independent of these technological issues is the question of what we will want to see overlaid on our world. I will suggest some of the possibilities, ranging from nothing (Can we really improve on a perfect sunset?), to satisfyingly minimalist (a single arrow pointing to the next button to push in a maintenance procedure), to breathtakingly photorealistic (experiencing today the Forum Romanum of two millennia ago). Along the way, I will discuss why many of the CPU cycles in these future devices will be spent designing what we see, not just rendering it.

5.1   Panelist Feiner Bio

Steven Feiner is a Professor of Computer Science at Columbia University, where he directs the Computer Graphics and User Interfaces Laboratory. He received a Ph.D. in Computer Science from Brown University in 1987. His research interests include virtual environments and augmented reality, knowledge-based design of graphics and multimedia, information visualization, wearable computing, and hypermedia. Prof. Feiner is coauthor of Computer Graphics: Principles and Practice (Addison-Wesley, 1990) and of Introduction to Computer Graphics (Addison-Wesley, 1993). He is an associate editor of ACM Transactions on Graphics, has served on the executive boards of the IEEE Computer Society Technical Committee on Visualization and Graphics and the IEEE Computer Society Task Force on Human-Centered Information Systems, and is a member of the steering committees for the IEEE Symposium on Information Visualization, the IEEE and ACM International Symposium on Augmented Reality, and the IEEE International Symposium on Wearable Computers. Over the past year, he has been general chair of IEEE Information Visualization 2001, symposium co-chair of the IEEE and ACM International Symposium on Augmented Reality 2001, and program co-chair of the International Symposium on Mixed Reality 2001. In 1991 he received an Office of Naval Research Young Investigator Award.

6   Kari Pulli

Hardware architectures, power, performance, software architectures, and interaction issues are big questions facing manufacturers looking to use computer graphics. The desktop paradigm that current computer graphics seems to focus on is not going to be the same one that is used for mobile technologies. Mobility enables something more than a desktop system does: the device can be always with you where ever you go, and the services and the imagery can be tailored to your current location and context.

In future research, many factors need to be considered, and new architectures have to be studied and developed, or old ones adapted, to deliver the usability and services that end-users demand. This covers all aspects of computer graphics, such as screen technology, software architectures and APIs, as well as interaction techniques.

6.1   Panelist Pulli Bio

Kari Pulli is a Principal Scientist at Nokia Mobile Phones where he heads research activities that ensure mobile devices becoming visually interesting communication systems, from the input (cameras) to the output (displays and graphics). After receiving his PhD in 1997 from University of Washington in Seattle, Kari worked at Stanford University, heading the technical aspects the Digital Michelangelo project. His current academic affiliation is at University of Oulu, where he teaches computer graphics. Kari's previous industrial experience stems from stints at Microsoft, SGI, and Alias|Wavefront.